ELECTRON MICROSCOPE STUDY OF EFFECTS OF CERTAIN AGENTS ON *ESCHERICHIA COLI*

BY

ABRAHAM EISENSTARK

A. B., University of Illinois, 1941

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AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN BACTERIOLOGY IN THE GRADUATE COLLEGE OF THE UNIVERSITY OF ILLINOIS, 1948

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R. UNIV. BIBLIOTHEEK LEIDEN

ELECTRON MICROSCOPE STUDY OF EFFECTS OF CERTAIN AGENTS ON *ESCHERICHIA COLI*

Review of the literature indicates that the electron microscope may be an important accessory instrument in solving certain biological problems. However, an understanding of limitations of the instrument is necessary and many special techniques must be developed before maximum usefulness may be attained.

This investigation was carried out to determine whether the electron microscope would reveal changes in morphology of *Echerichia coli* cells when they are treated with certain agents. Preparation of samples for electron microscopy was made in the standard manner described by Marton (1941). All bacterial cultures were grown in nutrient broth (Difco, dehydrated) and incubated at 37°C. Since variation sometimes occurs in cultures to which no special agent has been added, control experiments were carried out to verify that changes observed were caused by the treatment applied. In addition to electron microscope observations, Gram and Feulgen stained slides were made.

Treatment of *Escherichia coli* with organic solvents showed only minor changes in the structure of the organisms. Increased visibility of the bacteria was attained by aging and starving of cells. This permitted a study of vacuoles, internal bodies and cell envelopes. Fixation of cells by mercuric chloride, followed by starvation of the organisms, promises to be a usefu method of identifying internal protein bodies. Although bacteria treated with a quaternary ammonium compound were surrounded by a clear zone, no hint was obtained as to mode of action of these agents in disinfection.

Interesting observations were made when *Escherichia coli* were X-rayed or when they were exposed to methyl bis(beta-

chloroethyl) amine, a nitrogen mustard. There was a striking similarity between morphological changes which occurred. In both cases, organisms seemed to lose their ability to divide, but they containued to elongate. Periodic sets of granules which stained with Feulgen, were present in these elongated bacteria. Particularly in the case of nitrogen mustard, clumping of cells occurred, with minute granules surrounding these small colonies. Vacuolization and bulging of cells were other abnormalities observed in both X-ray and nitrogen mustard treatment.

Plasmolysis occurred very slowly when organisms were subjected to high concentrations of salt. Lithium chloride produced a few bizarre forms. Sulfonamides and colchicine failed to produce morphological changes.

Results of this investigation indicate that the electron microscope may be a useful instrument in the study of effects of certain agents on bacteria.

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VITA

The author was born September 5, 1919, in Warsaw, Poland. He came to the United States in April, 1921. He attended elementary school in Kansas City, Missouri, and was graduated from Central High School of that city in 1936. His first two years of college work were taken at Kansas City Junior College. He received B. A. degree in 1941 and M. A. degree in 1942, both from the University of Illinois. He spent 41 months in U. S. Army as a laboratory technician. Thirty months of this time was spent in the Southwest Pacific theater of operation. Since September, 1946, the author has been a special research assistant as operator of the electron microscope for biology departments of the University.

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